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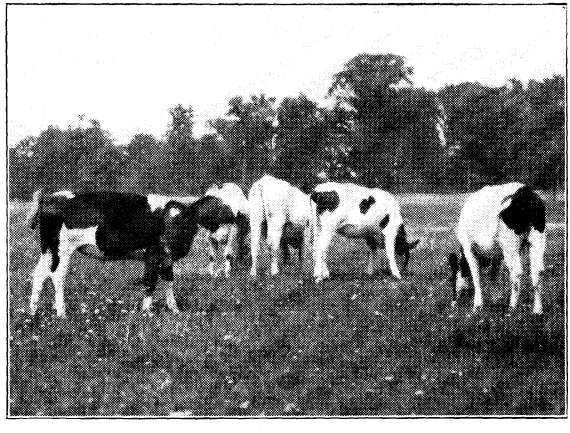

Limestone and acid phosphate have greatly improved this old permanent pasture

The Ohio Agricultural Experiment Station

March, 1927

FOREWORD

The Trumbull County Experiment Farm is located two miles west of Cortland. It contains 153 acres, of which 62 acres are used for growing feed for the dairy herd, and 22 are in 205 tenth-acre plots. Each plot is planted separately, harvested separately and its record secured.

Altho the farm is owned by Trumbull County, it is under the supervision of the Ohio Agricultural Experiment Station. The work is thus correlated with the work at Wooster which insures a better interpretation for Trumbull County farmers. The resulting conclusions, which in reality are contributions to "Ohio's Agricultural Information", are written for this issue of "Facts for Farmers" by members of the Experiment Station staff. This bulletin therefore has special reference to Trumbull and nearby counties of similar soil type and season.

The Trumbull County Experiment Farm is financed by the proceeds of farm sales, and by appropriations from the county commissioners. Also, two years ago the state legislature started an annual appropriation which it is hoped will continue. On the basis of $2,000 appropriated by the county, a farmer pays 7 mills for $1,000 of his tax duplicate, or 3½ cents on a $5,000 duplicate. The cost to him therefore is almost negligible.

Because of the limited size of this bulletin not all the work is reported. There are interesting projects on drainage, pasture improvement, soybeans, alfalfa, crop rotations, and legumes for hay which will be reported in later publications.

C. G. Williams, Director, Ohio Experiment Station
Myron A. Bachtell, In Charge of District and County Experiment Farms
Chas. H. Crawford, Supt. Trumbull County Experiment Farm

WORK WITH THE DAIRY HERD

CHAS. H. CRAWFORD, FARM SUPERINTENDENT
CHAS. F. MONROE, DEPARTMENT OF DAIRYING

All the cattle on the Trumbull County Experiment Farm, except two grades, which will be disposed of this year, are purebred Holsteins. Almost any dairyman could have such a herd, as no females have been purchased for several years, the herd being replenished by heifer calves of the farm's own breeding.

The sires used in the past have been moderately priced, but they were selected with some care from good producing families. It is encouraging to know that the daughters of these bulls have been quite uniformly better producers than their dams, which after all is the true test of any breeding.

Ohio Station Pilot No. 413,445, the herd sire now in use on the Trumbull County Experiment Farm, has a long line of high producing ancestors. He was bred at the Ohio Experiment Station and comes from the family of which Grace Daw 2d may be considered the foundation cow. This good cow in eleven consecutive 365-day lactation periods averaged 12,114 pounds of milk and 417 pounds of butterfat. In ten of these periods she was milked twice a day and received ordinary herd care.

There have been four generations of females descending from Grace Daw 2d. The average of 58 lactation periods in these four generations is 11,767 pounds of milk and 428.9 pounds of butterfat. Grace Darling Hengerveld No. 242,862, the dam of Ohio Station Pilot, was a granddaughter. Her average for eight consecutive lactation periods is 13,391 pounds of milk and 497.9 pounds of butterfat.

Ohio Station Pilot thus comes from a uniformly good producing family, and it is hoped that he will pass on to his daughters in the Farm herd the characteristics of consistent heavy milk production which are possessed by the female members of his family. None of his daughters are yet in milk but they show external characteristics of making profitable dairy cows.

Starting the cow test association year on April 1, 1925, the Trumbull County Experiment Farm herd finished with the following record, which is the average of 14 cows:

Average milk produced	11,453 pounds
Average test	3.34 percent
Average butterfat produced	382.1 pounds
Cost of feed per cow	$126.73
Value of milk per cow	$286.50
Value over cost of feed	$159.77
Return per $1.00 of feed	$ 2.26
Feed cost of 100 pounds milk	$ 1.10
Feed cost of 1 pound butterfat	$ 0.33

That it pays to feed cows of this type well is illustrated by a comparison of the records of ten of the cows for 1925 with those of the previous year when they were in the herd, but were fed a much less liberal ration.

TABLE 1.—Heavy vs. Light Feeding of Ten Dairy Cows

	Pounds milk	Pounds butterfat	Feed cost	Value of products	Balance over feed cost
1924	89,402	3030	$980.34	$1956 60	$976.26
1925	113,666	3726	1143.03	2523.47	1380.44

As a result of a better balanced ration, more liberal feeding, and a change in the method of feeding there was an increase of 24,264 pounds of milk and 696 pounds of butterfat. An increased expenditure of $162.69 for extra feed returned $566.87, or practically $3.50 for each dollar invested in feed.

During the past four years some effort has been made thru the use of this herd to find out the effect of feeding minerals to dairy cows. It is very difficult to measure the effect of mineral supplements because of the difficulty in maintaining two lots of cows that are known to be sufficiently uniform in other characteristics to make a comparison fair. However, the dairy herd was divided at the start of this test into two lots as nearly alike as possible. No effort has been made to retain the original animals and any cow that became unprofitable was sold regardless of the group to which she belonged and her place filled by a heifer raised on the farm.

All the cows have been fed alike with the exception that the mineral group received grain containing 2 percent of calcium phosphate while the non-mineral group received the same grain without the addition of any mineral. The roughage for each group consisted of silage and a good grade of mixed hay grown on the farm. The land, it might be mentioned, has received regular liming since its start and has been well treated with acid phosphate. The majority of dairymen in Trumbull County probably do not treat their soil as well, altho some of them do as well or even better than

the Experiment Farm. In summer, the cows have access to two pastures one of which is considerably above the average due to treatments with limestone and acid phosphate. Since both lots of cows have received the same winter roughage and have had access to the same summer pasture, it is impossible to state what the outcome would be had the land not been so well treated with limestone and phosphorus, which indirectly get to the cows thru the hay and grain produced.

In this test, conducted on a well-limed and heavily fertilized farm, the milk production records show no indication, and the breeding records but slight indication, of the value of extra minerals in the ration. Of the two highest producing cows on the farm one is in the mineral and one in the non-mineral group. When comparing milk production, the best records of the seven cows in the non-mineral group averaged 10,340 pounds of milk as compared with an average of 10,490 pounds for the best records of the nine cows in the mineral group. The difference of 150 pounds in favor of the mineral group is far from being significant.

In the breeding records there is a suggestion of some benefit from the extra minerals in the grain. For 23 lactation periods in the mineral group there were required 34 breeding services or an average of 1.5 for each conception. For the 17 lactation periods in the non-mineral group there were 32 breeding services or an average of 1.9 for each conception. One cow in the non-mineral group required only four breeding services for four conceptions altho another one required eight for three conceptions. This latter cow happens to be the highest producer on the farm, a fact which may or may not have significance. More data are needed to make this evidence conclusive since, as noted above, one cow in a small group can influence too greatly the average results.

Under the conditions of soil management that have been followed on the Trumbull County Experiment Farm and with the quality of roughage that has been fed it is a question whether mineral supplements are of any benefit. But where the minerals have not been applied to the soil and where more timothy hay is fed, there is evidence that feeding minerals is a safety measure which, in the light of our present knowledge, it is wise to follow.

Calcium phosphate has been fed to the cows on the Trumbull Farm but this will be changed to a special bone meal which is now on the market, and which is as cheap and satisfactory as any other form of calcium and phosphorus. In addition to salt these elements are the only two (iodine possibly excepted) that, so far as now known, need be considered.

THE EFFECT OF FERTILIZERS, MANURE, AND LIMESTONE ON CROP YIELDS

R. M. SALTER AND J. S. CUTLER, DEPARTMENT OF AGRONOMY

The Trumbull County fertility experiments have now been running for 11 years, a period sufficiently long to justify fairly accurate conclusions. The rotation on which these tests have been made is the common four-year rotation of corn, oats, wheat, and mixed hay. This was selected as being a type of rotation followed on many farms in the county. Trumbull County farmers, therefore, should find in this report information of doubly proved value, especially since it is correlated with the results secured at Wooster.

TABLE 2.—Plan of Fertility Experiment on Limed Land

Rotation: Corn, oats, wheat, mixed hay.
Basal Treatment: 2 tons fine limestone over all, applied on corn.

Plot No.	Materials applied	Application on			Applications for rotation	
		Corn	Oats	Wheat	Total	Cost
		Lb.	*Lb.*	*Lb.*	*Lb.*	*Dol.*
1	None	.....	.....	.....	.....	.....
2	0—16—0	200	100	200	500	5.45
3	0—16—4	200	100	200	500	8.05
4	None	.....	.....	.....	.....	.....
5	4—16—4	200	100	200	400	11.40
6	2—8—2*	400	200	400	1000	15.50
7	None	.....	.....	.....	.....	.....
8	9—12—8	500	.....	500	1000	31.08
9	Manure + 0—16—0	4 T. 240	.....	4 T. 240	8 T. 480	13.23
10	None	.....	.....	.....	.....	.....
11	Manure + 0—16—0 + 4—16—6	8 T. 480	100	 350	8 T. 580 350	22.56
12	Manure + 0—16—8	4 T. 250	.....	4 T. 250	8 T. 500	12.40
13	None	.....	.....	.....	.....	.....
14	Manure	4 T.	....	4 T.	8 T.	8.00

*Commercial mixed fertilizer.

The soils on which the fertility tests have been conducted are the common soils of Trumbull County, that is, the Mahoning silty clay loam and the Trumbull silty clay loam. It should be especially emphasized that these soils were formed from glacial drift derived from sandstones and shales. Limestone rock thus had no part in their make-up, a fact which acounts for their naturally acid condition. Of the two soils, the Trumbull is the more level, has the grayer color, poorer drainage conditions, and is the more acid. In the eastern part of the county the Canfield and Volusia soils pre-

dominate. These are very similar to the Trumbull and Mahoning soils, except that they have a more porous subsoil, and hence have slightly better natural drainage and are not as acid.

In any comparative test of fertilizers as many limiting factors as possible must be eliminated. For this reason this test is conducted on tile drained land which receives ground limestone every four years.

Fertilizing the corn crop.—Corn yields as a rule are low in Trumbull County, the average for the last three years being 31 bushels per acre. Yields like this do not leave much for profit. Low yields are caused partly by the climate and partly by the soil. A short cool growing season together with a heavy, poorly drained soil that warms up slowly prevents rapid growth which in turn necessitates an early maturing variety. The fertilizer treatment must be one that will increase the yield profitably under these unfavorable growing conditions.

TABLE 3.—Fertilizers and Manure on CORN in Rotation with Oats, Wheat, and Mixed Hay

Yield and increase per acre on limed land, 9-year average

Plot No.	Treatment per acre in addition to lime*	Yield		Increase	
		Grain	Stover	Grain	Stover
		Bu.	*Lb.*	*Bu.*	*Lb.*
1	None	32.50	1816		
2	0—16—0, 200 lb	39.17	2044	6.5	260
3	0—16—4, 200 lb	40.26	2068	7.43	318
4	None	33.00	1717		
5	4—16—4, 200 lb	40.68	2087	8.17	363
6	2—8—2, 400 lb	39.57	2055	7.53	328
7	None	31.55	1731		
8	9—12—8, 500 lb	46.82	2396	13.68	532
9	Stall manure, 4 T. + 0—16—0, 240 lb.	51.20	2486	16.48	509
10	None	36.31	2100		
11	Stall manure, 8 T. + 0—16—0, 480 lb.	53.57	2520	18.05	498
12	Stall manure, 4 T. + 0—16—8, 250 lb.	50.02	2464	15.28	521
13	None	33.95	1865		
14	Stall manure, 4 T	42.34	2101	8.39	235
	Average fertilized yield	44.85			
	Average unfertilized yield	33.46			

*Basal treatment, 2 tons fine limestone on corn over all plots.

The value of manure as a fertilizer for corn has long been recognized. Some facts concerning the limitations of manure, however, are shown by the Trumbull tests. An 8-ton application of well-cared-for manure, split equally between the corn and wheat crops on Plot 14, when compared with Plot 13, which receives no manure, gave an average increase for manure of 8.39 bushels of

corn, 2.54 bushels of oats, 3.48 bushels of wheat, and 535 pounds of hay. This makes a value of $15.27, or $1.90 per ton of manure.

While manure is valuable enough to be well worth saving and spreading it is evident that it needs to be liberally supplemented with acid phosphate to get maximum results on soils as deficient in phosphorus as those in Trumbull County. The same amount of manure is applied to both Plots 9 and 14, but Plot 9 receives in addition 480 pounds of acid phosphate in 4 years. Adding the acid phosphate has given a further increase of 8.1 bushels of corn, 7.1 bushels of oats, 6.1 bushels of wheat, and 635 pounds of mixed hay, with a total value of $20.94 compared to a cash outlay of $5.23 for the acid phosphate. Applying all of the manure and acid phosphate on the corn crop (Plot 11) increased the corn yield only 1.57 bushels over that obtained where the application is split between corn and wheat. This practice, moreover, has necessitated a more expensive fertilizer for the wheat and somewhat lessened the chance of getting a stand of clover.

Potash as a further supplement to manure has failed to increase the yields. This is shown by comparing the yields secured on Plots 9 and 12, both of which receive the same amount of manure and acid phosphate, but Plot 12 receives potash in addition. The results indicate that on the heavy soils of northeastern Ohio the purchase of potash is unprofitable when as much as 8 tons of manure per acre is used every four years.

In the absence of manure acid phosphate applied broadcast at the rate of 200 pounds per acre on corn (Plot 2) has increased the yield 6.5 bushels per acre. This increase has a value of $4.55, compared with a fertilizer cost of $2.18. Neither potash on Plot 3 nor nitrogen on Plot 5 when added to the phosphate treatment has increased the yields sufficiently to cover the added cost of the treatment.

Limestone, manure, and acid phosphate thus make a cheap and effective treatment for corn. Recent experiments at Wooster indicate that supplementing this treatment with 100 pounds per acre of a high grade complete fertilizer, such as 2-12-2, 2-16-2, or 3-12-4, in the hill or row is likely to prove profitable, especially on the poorly drained heavy clay soils in the county.

Oats respond to fertilizers.—Trumbull County may rank far down the list in corn production but it is near the top in yield of oats. This is an important crop from the standpoint of feed and as a grain crop with which to sow clover and grass seed.

TABLE 4.—Fertilizers and Manure on OATS in 4-year Rotation of Corn, Oats, Wheat, and Mixed Hay

Yield and increase per acre on limed land, 10-year average

Plot No.	Treatment* per acre	Yield		Increase	
		Grain	Straw	Grain	Straw
		Bu.	*Lb.*	*Bu.*	*Lb.*
1	None	43.40	2,092		
2	0—16—0, 100 lb.	51.43	1,918	7.27	−158
3	0—16—4, 100 lb.	53.43	2,178	8.52	117
4	None	45.67	2,044		
5	4—16—4, 100 lb.	54.32	3,060	9.14	85
6	2—8—2, 200 lb.	53.10	1,946	8.41	37
7	None	44.20	1,841		
8	On corn and wheat	51.23	1 993	6.84	149
9	On corn and wheat	54.21	2,255	9.64	409
10	None	44.76	1,848		
11	0—16—0, 100 lb.	57.86	2,390	13.57	430
12	On corn and wheat	53.15	2,104	9.23	32
13	None	43.45	2,183		
14	On corn and wheat	45.99	2,076	2.54	−108
	Average fertilized yield	52.75			
	Average unfertilized yield	44.30			

*Basal treatment, finely ground limestone 2 tons per acre on corn over all plots.

Oats have long been considered a sort of clean-up crop utilizing any residual effect of the fertilizer treatment applied to the corn. The fertility experiment however indicates that Trumbull County farmers may well consider fertilizing the oat crop. Especially is this true where grass seed is sown with the oats. The fertilizer application then may well be increased to 200 or even 300 pounds per acre, depending on whether the corn crop received a heavy or a light application. A fairly reliable guide is to apply 480 pounds per acre of 20 percent acid phosphate in a three-year rotation of corn, oats, clover. If the corn crop receives only a small part of the treatment, the oats should receive a proportionately larger amount. Under conditions of the Trumbull County test mixed fertilizers have been less profitable than acid phosphate on oats.

Wheat responds to complete fertilizers.—Wheat responds to a complete fertilizer, especially where sufficient manure is not produced so that the crop can be given a top-dressing. The Trumbull fertility experiments indicate that a complete fertilizer should be the most profitable on the cold, poorly-drained soils of northeastern Ohio.

Where wheat can be top-dressed with manure, the lesson of Plot 9 is that 240 pounds of acid phosphate applied at sowing time and 4 tons of manure put on in the winter have increased the yield 9.6 bushels per acre. This plan is admirably adapted to the dairy farm which has a relatively small acreage of wheat.

Without manure, the largest yields have been secured by the use of complete fertilizers. But because the mixtures used on Plot 5 (4-16-4) and on Plot 8 (9-12-8) were poorly proportioned and excessively high in costly nitrogen, these plots have not been the most profitable. However, correlating the Wooster tests with these it would seem that a less expensive fertilizer of the 2-16-2 type would give the advantage of a small amount of nitrogen to increase tillering and produce greater vigor in the fall at a not excessive cost.

TABLE 5.—Fertilizers and Manure on WHEAT in 4-year Rotation of Corn, Oats, Wheat, and Mixed Hay

Yield and increase per acre on limed land, 10-year average

Plot No.	Treatment per acre	Yield		Increase	
		Grain	Straw	Grain	Straw
		Bu.	*Lb.*	*Bu.*	*Lb.*
1	None	18.73	1709		
2	0—16—0, 200 lb.	29.17	2447	10.05	663
3	0—16—4, 200 lb.	30.47	2521	10.96	690
4	None	19.89	1905		
5	4—16—4, 200 lb.	30.83	2670	11.47	782
6	2—8—2, 400 lb.	28.79	2572	9.97	700
7	None	18.30	1855		
8	9—12—8, 500 lb.	34.74	3105	15.31	1322
9	Stall manure, 4 T. 0—16—0, 240 lb.	28.17	2404	9.61	693
10	None	18.69	1638		
11	4—16—6, 300 lb.	29.57	2645	11.52	1027
12	Manure, 4 T. 0—16—8, 250 lb.	27.07	2470	9.78	874
13	None	16.65	1575		
14	Stall manure, 4 T.	20.13	2057	3.48	482
	Average fertilized yield	28.77			
	Average unfertilized yield	18.45			

The 2-8-2 applied on Plot 6 need not be considered. It is no longer a recommended analysis. In tests at Wooster, increasing the phosphoric acid from 8 percent in the 2-8-2 to 12 percent in the 2-12-2 has largely increased the profit. The 2-16-2 perhaps would have been still more profitable. An increase in the ammonia however to 4 percent has lowered the profit.

Liming essential to best results.—Good clover crops are seldom if ever produced in Trumbull County without liming. The amount of limestone required varies with the character of the soil and the previous manure and fertilizer treatment. The county agricultural agent is prepared to test soils for farmers and recommend a desirable application.

The lime test on the Trumbull County Experiment Farm shows that liming has materially benefitted all crops grown. The average yields of Plots 16, 19, 22, and 25, receiving manure and acid phos-

TABLE 6.—Residual Effect on Meadow of Treatment on Previous Crops in 4-year Rotation of Corn, Oats, Wheat, and Mixed Hay; With Value of Increases for Entire Rotation and Cost of Treatment

Yield and increases per acre, 8-year average

Plot No.	Treatment per rotation on previous crops*	Hay		Per rotation		
		Yield	Increase	Value of increases	Cost of treatment	Balance
		Lb.	*Lb.*	*Dol.*	*Dol.*	*Dol.*
1	None	2093				
2	0—16—0, 500 lb.	3119	989	27.44	5.45	21.99
3	0—16—4, 500 lb.	2845	679	27.40	8.05	19.35
4	None	2203				
5	4—16—4, 500 lb.	3017	826	29.92	11.40	18.52
6	2—8—2, 1000 lb.	2938	757	26.77	15.50	11.27
7	None	2168				
8	9—12—8, 1000 lb.	3554	1385	41.85	31.08	10.77
9	Manure, 8 T. + 0—16—0, 480 lb.	3340	1170	36.19	12.23†	22.96
10	None	2171				
11	Manure, 8 T. + 0—16—0, 580 lb. + 4—16—6, 350 lb.	3365	1268	41.98	22.56†	19.42
12	Manure, 8 T. + 0—16—8, 500 lb.	3129	1107	34.92	16.40†	18.52
13	None	1948				
14	Manure, 8 T.	2484	535	15.25	8.00†	7.25
	Average fertilized yield	3088				
	Average unfertilized yield	2117				

*Basal treatment, 2 tons fine limestone applied to each corn crop.
†A charge of $1.00 per ton is made against manure to cover the cost of spreading.

Values used:		
	Corn with its stover	$ 0.70 per bushel
	Oats with their straw	0.40 per bushel
	Wheat with its straw	1.25 per bushel
	Mixed hay	15.00 per ton

phate but no limestone, have been corn 39.0 bushels, oats 43.7 bushels, wheat 20.4 bushels, hay 1965 pounds, with a total value for the rotation of $85.09. A similar average of the yields of Plots 15, 17, 18, 23, and 24, receiving limestone in addition to manure and acid phosphate, shows corn 45.5 bushels, oats 49.3 bushels, wheat 24.4 bushels, and hay 2679 pounds, with a total value for the rotation of $102.17. The apparent increase per rotation for liming has been $17.08. This assumes that the hay produced in both cases had the same value, which is not true, since without limestone the hay contained very little clover, while with limestone it was mostly clover. A fair allowance for the increased feeding value of the hay from the limed plots would raise the gain for liming to at least $25.

Results secured in the Trumbull County lime tests indicate somewhat better returns from applying the lime on the corn ground than for the wheat. At Wooster lime applied to the clover sod before plowing gave results equal to applications made after plow-

ing. By spreading lime on sod ground during the fall the farmer can greatly reduce the labor required during the busy planting season.

Lime or drainage, which?—Tests on the Trumbull County Farm have shown clearly the need for both lime and tile drainage. These two needs are usually linked together so that the problem of both lime and tile drainage must be met before maximum results can be secured. However, because of the heavy initial cost, it usually is financially impossible both to tile the land and to apply lime when beginning soil improvement. Under such a condition best results will probably be secured by applying the lime first and draining later. The increased yields secured by liming will thus aid in paying for tile drainage.

TABLE 7.—Comparison of Different Forms of Lime, Applied on Different Crops in the Rotation and Yield per Acre for All Crops

Basal Treatment: Stall Manure, 4 T. and 0-16-0, 240 lb. on corn and wheat

Plot No.	Treatment per acre per rotation	Applied on	Corn 9-year av. yield	Oats 10-year av. yield	Wheat 10-year av. yield	Clover 8-year av. yield
			Bu.	*Bu.*	*Bu.*	*Lb.*
15	Fine limestone, 1 T. / Fine limestone, 1 T.	Corn / Wheat	47.77	49.84	25.08	2,785
16	No lime		38.93	45.14	20.70	2,104
17	Fine limestone, 2 T.	Wheat	44.74	50.65	23.26	2,717
18	Coarse limestone, 4 T. / Alternate rotations	Corn	46.37	48.89	24.79	2,760
19	No lime		42.45	44.59	22.05	2,058
22	No lime		37.76	41.71	19.55	1,872
23	Hydrated lime, 1 T.	Corn	45.58	48.96	24.72	2,698
24	Hydrated lime, 1 T.	Wheat	43.00	47.94	24.32	2,436
25	No lime		36.91	43.38	19.50	1,828
	Average yield limed		45.49	49.26	24.43	2,679
	Average yield unlimed		39.01	43.71	20.45	1,966

The type of farming, will partially determine the necessity of tiling. To secure the best results with such crops as wheat, alfalfa, potatoes, and vegetables tile drainage is necessary. Good yields of other crops however may be secured without tile, and a fairly profitable farming system is possible on untiled land where systematic treatment with lime, manure, and fertilizers is followed.

VARIETY AND CULTURAL EXPERIMENTS

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The variety tests on the Trumbull County Experiment Farm are conducted on tiled land which receives an application of limestone every four years. Manure is applied to the corn crop at the rate of 8 tons per acre. The wheat receives 200 pounds of acid phosphate at sowing time and 4 tons of phosphated manure as a top-dressing during the winter, and the oats receive 150 pounds of acid phosphate. The clover mixture sown in the wheat consists of red clover, alsike clover, alfalfa, and timothy.

Silage corn.—Of primary interest in the dairy sections of Ohio where the silo has become a practical necessity is the question of the proper variety of silage corn. Varieties may be compared both on the basis of the total tonnage and the total nutrients produced.

Seven varieties have been compared over a period of ten years. The plots are planted thick and then thinned to a uniform stand of three stalks per hill in rows 42 inches apart each way. The varieties may be roughly classified according to their time of maturity. Clarage and Leaming, both medium season varieties and sometimes used for grain production, have given yields of 7.64 and 8.52 tons per acre, respectively. Darke County Mammoth and Reid Yellow Dent are later in maturity, and have yielded 9.24 and 9.34 tons. The large, late, so-called "silage corns", Eureka, Old Virginia, and Blue Ridge have yielded 11.10, 10.89, and 9.75 tons, respectively. Thus on the basis of field tonnage, the large late types have excelled in yield.

Dairymen have found that silage made from the large, late varieties must be supplemented with a greater amount of concentrated feeds than that made from the medium season varieties. Analyses at the time of ensiling show that the large, late varieties contain less protein and fat than the medium season varieties. This difference is primarily due to the greater proportion of grain to stalk in a medium season corn.

The best quality silage is made from corn which has reached the glazed or dented stage of maturity. At this stage the percentage of nutrients is higher and the total digestible nutrients per acre are greater than from less mature corn. This is shown in Table 8 which gives the comparative nutrients of Leaming, Reid Yellow Dent, and Blue Ridge on an acre basis.

TABLE 8.—Medium Season vs. Large Late Varieties of Corn for Silage

Comparative yields and feeding value per acre, 9-year average, 1915-1924

Variety	Maturity	Yield*	Water	Protein	Fat	Crude fiber	Nitrogen free extract	Total digestible nutrients†
		T.	*T.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Leaming	Medium	8.36	5.48	421	124	1,167	3,836	4,535
Reid Yellow Dent..	Late	8.82	6.35	370	85	1,122	3,124	3,685
Blue Ridge	Very late	9.14	6.59	360	71	1,364	3,062	3,582

*Tonnage yields from Trumbull Farm, but calculations based on average analyses of the variety at time of ensiling when grown at Wooster.

†Total digestible nutrients=Proteins+Nitrogen-free-extract+(Fat X 2.25).

The varieties are compared over a 9-year period. The analyses used in calculating this table are an average of from 5 to 8 crops grown at Wooster. Leaming, while yielding .78 tons per acre less on the basis of field weights, actually produced 953 pounds more of digestible nutrients than the Blue Ridge ensilage corn. Leaming also produced more protein and fat, and less fiber than the Blue Ridge, making a superior silage from a feeding standpoint.

Using 100 as a basis of comparison, Blue Ridge was only 79 percent as efficient as Leaming when the total nutrients produced per acre are considered. Varieties, such as Leaming and Reid Yellow Dent, which are grown for grain in southern Ohio are recommend for silage in Trumbull County.

Special cultural suggestions.—Early planting of late maturing silage varieties and the need of a full stand are important points in the production of silage corn in northeastern Ohio as shown by the data and observations of the past ten years. Frequently silage corn is not planted until after the grain crop. The silage resulting from this late planting is watery and contains less total nutrients. In the experiments at Wooster, early planting has given both the highest yields and the best quality silage. These plantings were made from May 1 to 10, which is ten days earlier than corn for grain production is normally planted. In Trumbull County early planting of silage corn is desirable.

Observations show that the average silage corn is planted too thin rather than too thick for maximum yields. At Wooster the highest yields have been secured with the plants spaced 10 inches apart in the row and the rows 42 inches apart. While insects, diseases, etc., tend to cut down the stand secured, even tho the seed germinates perfectly, failure to adjust the planting rate to the size of the kernel has a greater effect. To secure a plant every 10 inches in the row about 6 quarts of a medium sized corn such as the Leaming, and 9 quarts of large kerneled varieties such as the Blue Ridge and Eureka are required.

Experiments with oats.—In the oats variety tests Big Four ranks first, Silvermine second, and Miami third. Miami, originated by the Ohio Agricultural Experiment Station in 1906, is a pure line selection from the old Siberian. Due to its high yield, medium sized plump berry and fairly stiff straw, Miami bids fair to become the leading variety in northeastern Ohio. Silvermine, while yielding slightly better than Miami, has a weaker straw and hence is more subject to lodging. There are many strains of both Big Four and Silvermine, some high yielding, others low yielding. Because of these strain differences and the fact that these varieties show considerable mixture they can scarcely be recommended as highly as Miami. Pure certified seed of the Miami is available. Ohio 201, another pure line selection from Siberian, is exceedingly stiff strawed and resistant to lodging. Miami has the lowest yield of straw, while Ohio 201 has the largest. The straw-grain ratio, or the pounds of straw per bushel of grain, is a good index of the height of straw of each variety.

TABLE 9.—Oats Variety Test

Yield per acre and pounds of straw per bushel of grain, 1916-1925

Variety	Number years tested	Grain per acre	Straw per acre	Straw per bushel grain
		Bu.	*Lb.*	*Lb.*
Big Four	8	55.94	2,326	41
Silver Mine	8	55.84	2,418	43
Miami	8	54.50	2,079	38
Ohio 6222	8	51.65	2,379	46
Ohio 201	7	50.26	3,134	62
Corn Belt	7	48.95	2,453	50

What about red oats?—Northeastern Ohio is recognized as a white oats producing section. The cool and moist weather during spring and early summer favor the medium season white oat varieties. Recently an early red oats, Fulghum, was introduced into this section. It originated in the south and is especially adapted to regions where oats must mature before hot summer weather sets in, a condition which does not prevail in northeastern Ohio. Compared with Miami, Fulghum has yielded 55 bushels per acre as against 60 for Miami during the last two years. The growing of a red oats such as Fulghum in a white oats producing area can only result in time in the production of mixed oats which sells at a substantial discount. Due both to its earliness and small straw, Fulghum may have a place as a grain crop with which to sow alfalfa. Present performances indicate, however, that northeastern Ohio should stick to a standard white oat for grain production.

THE
NATIONAL DAIRY ASSOCIATION
AWARDS
THIS DIPLOMA TO

Trumbull County Experimental Farm

IN RECOGNITION OF HIS ACHIEVEMENT IN DEVELOPING HIS HERD OF COWS TO A YEARLY PRODUCTION OF OVER 300 POUNDS OF BUTTERFAT.

BY AUTHORITY OF THE BOARD OF DIRECTORS.

Charles L. Hall
PRESIDENT

W. H. Brunner
SECRETARY

OCTOBER 17, 1925